

History of the USGS Wisconsin District, 1979 – 1994

By Warren A. Gebert

INTRODUCTION

As the 1979-94 period began, the Wisconsin District office was located at 1815 University Avenue with field offices in Madison, Merrill, Rice Lake and Waukesha. The District office moved to 6417 Normandy Lane, Madison, in June 1987.

The Wisconsin District maintained a well-balanced technical program, not only between hydrologic surveillance and interpretive studies but also among the surface-water, ground-water, and water-quality disciplines.

Major Events

Several significant administrative and programmatic events occurred in the Wisconsin District during the period from 1979-94. These events started with the changes in the District Chief's office - Bill Mann 1979–80; Vernon Norman 1980–90; and Warren Gebert 1990–present.

There were changes in sections and section chiefs as well. When Fred Dreher retired in 1982, the Water Environment Monitoring Section was combined with the Hydrologic Systems Section to form the Hydrologic Systems and Data Section with Warren Gebert as Section Chief and Assistant District Chief. In 1990, that Section was split into the Hydrologic Systems and Data Section and the Environmental Studies Section. Herb Garn became section chief of the Hydrologic Systems and Data Section and Peter Hughes became the section chief of the Environmental Studies Section.

Dale Cotter retired from the position of section chief of the Hydrologic Studies and Data Section in 1987. Jim Krohelski became section chief of the Hydrologic Studies and Data Section in 1989.

The 1984 closing of the sub district office in Wales was due to a large reduction in the District's program. As a result of the District's budget problems, a number of employees were transferred: Tom Ross to Headquarters, Dan Olson and Roger McFarlane to the Illinois District, Paul Boetcher to the Florida District, Lee Trotta to the Minnesota District, and Jim Kammer to the New Jersey District. Fred Warner took an early retirement.

The Northern Midwest Regional Aquifer System Analysis Study was housed in the District Office from 1979-87. The study was a large multi-District ground-water modeling project. The study was attached to the Northeastern Region financially as were the personnel.

In 1987, the District office moved from 1815 University Avenue to 6417 Normandy Lane after being at the University Avenue location for 22 years.

In 1990, the Cartographic and Publication Unit had outgrown their space needs at the District office. Due to the increasing amount of national projects and space limitations, the Unit became the Cartography and Publication Program and moved to 550 Science Drive in Madison and was assigned to the Northeastern Region.

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During the late 1980s, the Wisconsin DNR became aware that a surprising number of lakes in remote locations contained game fish with high levels of mercury. These observations resulted in the start of the District's Mercury Program. The Mercury in Temperate Lakes (MTL) project and Florida Everglades were the District's first mercury projects and were directly responsible for redefining what we know about mercury concentrations, sources, and pathways to fish. The Office of Water Quality provided funding to establish the Wisconsin District Mercury Research Laboratory (WDMRL) in 1994. The WDMRL immediately began offering low-level mercury analysis for all the USGS and initiated a large, multi-agency mercury investigation in the Florida Everglades.

The National Water Quality Assessment Program (NAWQA) was also implemented in 1990 and the Western Lake Michigan Drainage Study, which was one of 20 study units funded in the first phase, was assigned to the Wisconsin District. This program required 8-10 full time people with funding of \$1.5M during the 3-year intensive phase that started in 1991 and was planned to last 30 years.

In 1991, the District went to four sections. Jim Setmire transferred to the District from California as project chief of the NAWQA Study, Herb Garn transferred from New Mexico to become section chief of the Hydrologic Studies and Data Collection Section and Peter Hughes became section chief of the Environmental Studies Section.

In 1992, the District initiated a Total Quality Management Program (TQM). This program had a significant impact on future District operations. A consultant, Jonathon Reed, was hired to train and assist the District in the implementation of the program. After the initial training was conducted, a Quality Improvement Council was selected that represented a cross-section of employees and helped to implement TQM in the District. Process action teams were formed to address areas of concern that the District staff had identified as part of the process. By 1994, a number of process action teams had successfully completed their study and recommendations for improving the processes had been implemented. The first process action teams were on report illustrations, report processing, computation of streamflow records and employee training. By the end of 1994, significant improvement had occurred as a result of work done by these teams.

Funding

Funding for the Wisconsin District during the 1979–94 period is shown in the table below. Funding increased from \$2,196,000 in 1979 to \$6,484,000 with most of the increase occurring after 1990. As shown, the funding increased substantially in all areas with the largest increase occurring in Federal funds with the addition of the Western Lake Michigan Drainage NAWQA study and Mercury Program being started. The District's sizeable increase in Federal matching funds and repay is the result of the District being very successful in the National Merit Study Competition and the NR Enhancement Studies Competition. During the period of the competition, the District was awarded eight studies.

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Wisconsin District Funds, Fiscal Years 1979-94

In Thousands

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990*	1991	1992	1993	1994
Gross Funding	2,196	2,595	2,881	2,782	2,663	2,887	3,181	3,153	3,505	3,596	4,030	3,645	4,384	5,151	5,907	6,484
Federal Matching	762	818	887	1,009	1,022	1,071	1,069	1,009	1,045	1,170	1,214	1,231	1,356	1,479	1,675	1,597
Repay and direct	762	818	887	1,009	1,022	1,071	1,069	1,009	1,045	1,170	1,214	1,231	1,356	1,479	1,675	1,597
Unmatched	30	28	32	6	23	6	6	67	5	5	196	562	550	258	183	373
Federal	273	485	585	410	284	435	728	722	981	1,080	1,157	238	589	1,288	1,791	2,042
OFA	369	446	490	348	312	304	309	346	429	171	249	383	533	647	583	875

*Cartographic and Publication Program (CAPP) became their own cost center

Cooperation

During the period 1979-94, the District continued to expand the type and number of projects and cooperators. In 1979, the District conducted 39 projects with 18 cooperators. The number of projects increased to 62 projects with 78 cooperators by 1994. The Wisconsin Department of Natural Resources (WDNR) and the University of Wisconsin Geological and Natural History Survey (UWG&NHS) were the primary cooperators during the 1979-94 period.

Number of Employees

At the beginning of the 1979-94 period, the Wisconsin District had a total of 68 employees, 60 permanent and 8 students. In 1981, the number of District personnel reached a high point of 92 employees, with 60 permanent and 32 other than permanent.

PERSONNEL

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
#Employees Total/Permanent	86/59	88/60	92/60	82/62	84/59	80/58	84/54	79/51	66/53	67/51	61/51	60/53	76/55	82/61	80/61	81/57
#Hydrologists	18	21	20	21	21	17	18	19	21	18	19	19	22	31	30	29
#Technicians	26	25	26	26	23	17	19	18	15	16	15	16	17	18	19	18
#Admin	5	4	5	5	5	5	5	4	6	6	6	6	6	6	6	4
#Computer	3	3	3	4	4	5	5	3	4	4	4	4	3	3	3	3
#Pub Staff	7	7	6	6	6	7	7	7	7	7	7	8	2	3	3	8

DISTRICT STRUCTURE AND ORGANIZATIONAL CHANGES

The organization of the District in 1979 was fairly typical of most USGS districts. There was a district chief, an assistant district chief, and three section chiefs for hydrologic systems, water environment monitoring and hydrogeologic studies. The Water Environment Monitoring Section was divided into four field headquarters—in Merrill, Madison, Rice Lake, and Waukesha.

The field headquarters in Waukesha was changed in 1980 to the Wales Sub-District Office where it operated until 1984 when it was closed due to funding problems in the District.

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The four support units reported to the Office of the District Chief. They were: Computer Applications Services Unit, Operations Services Unit, Water Quality Services Unit and Publications Services Unit.

DISTRICT ADMINISTRATION AND SERVICES

Office of the District Chief

At the beginning of the 1979-94 period, Bill Mann was the District Chief in Wisconsin. He transferred to Reston, Virginia, in 1980 to oversee the Water Use Program. That year, Vernon W. Norman became District Chief and remained with the Wisconsin District until he transferred to Denver, Colorado, in early 1990, into the Central Region's water-quality specialist position. Warren A. Gebert was selected as District Chief in December of 1990. Gebert remained District Chief throughout this period.

In 1979, the District had four assistant district chiefs. They were Dale Cotter who was also the Section Chief of the Hydrologic Studies Section, Fred Dreher who was also the Section Chief for the Water Environment Monitoring Section, Warren Gebert who was also the Section Chief for the Hydrologic Systems Section and Jack Green who was also the District Report Specialist. Dale Cotter retired in 1986, Fred Dreher in 1981, Jack Green in 1983 and, after Warren Gebert became District Chief, the "assistant" title was not attached to that of section chiefs.

During 1979-85, Betty Hamre held the position of District Chief's secretary. In May of 1985, Diane Maertz (Weber) took over the position.

Administrative Services Unit

Rick Grover continued in the position of Administrative Officer. Others who served in various capabilities in the Unit were: Diana Cutright, Mary Crawmer, Kathleen Mayer, Rachel Lansing, Edith Gillitzer, Kaye Evans, and Julie Wolf (Urban).

Computer Applications Unit

During the 1979-94 period, the USGS and the Wisconsin District joined the computer revolution in a big way. The Data100 RJE terminal (really a card reader to send jobs to the AMDAHL mainframe in headquarters) and microcomputers were replaced by a Prime minicomputer in 1983. In 1984, the processing of gage height records was moved to the Prime. In the next few years, all the USGS databases were moved from the AMDAHL to the Prime. In 1991, Data General servers and workstations running the UNIX operating system were purchased. With the addition of X terminals, local networking, and wide-area networks, everyone had access to computing capabilities on their desk.

In 1987, Robert McLeod took a job with a consulting firm in Atlanta and Bob Bodoh became the District Computer Specialist and was assigned supervisory duties for the unit. Others who worked in the unit were Gary Gill, Jeannette Zahn, and Robert Purvis.

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Publications Services Unit

The Publications Unit experienced significant growth during the 1980s with their work for headquarters on the National Water Summary and other national reports. Greg Allord was the Publications Unit Chief. Other personnel who worked in the unit between 1979 and 1990 were Wendy Danchuk, Nancy Dudley, Suzanne Hamilton, and Judith Lee.

In 1990, the Publication Unit was split off from the District due to their involvement with national reports. The entire unit moved from the District to form the Cartographic and Publication Program (CAPP) and was assigned to the Northeastern Region.

After the departure of the CAPP unit from the Wisconsin District, new publications personnel, Sue Jones and Karen Lonsdorf, were hired and were under the supervision of Phil Kammerer. In 1989, Jim Krohelski took over the supervisory duties.

OTHER UNITS

Hydrogeologic Studies Section—The Section Chief was Dale Cotter (1966-87) and then Jim Krohelski (1989–present). Other personnel who served in the section were: Bill Batten, Bernie Ellefson, Bob Erickson, Pat Emmons, Bob Devaul, Bob Lidwin, Chuck Dunning, John DeWild, Randy Hunt, Dave Krabbenhoft, Phil Kammerer, Gary Patterson, Lee Trotta, Terrence Conlon, Bart Manion, Jim Rauman, Ty Sabin, Jenny Schiller and Elaine Boyd.

Hydrologic Systems and Data Section (HSDS)—The section chief was Warren Gebert (1975–90). This section split into the Environmental Studies Section and Hydrologic Systems and Data Section in 1991. Personnel who were in HSDS during the period 1979–90, and left the District before the other sections were formed were Duane Conger, Roy Campbell, Carl Lawrence, Jane Hannukula, Leo House, Marv Duerk, Emery Hennrich and Jim Kammer.

Environmental Studies Section—The Section Chief was Peter Hughes (1990 to present). Other personnel in the section were Bill Krug, Jerry Goddard, Dave Graczyk, Nick Hanson, Dave Housner, John Walker, Leo House, Harry House, Jeff Steuer, Steve Corsi, Dave Owens, and Todd Stuntebeck.

Water Environmental Monitoring Section (1979-82) and Hydrologic Systems and Data Section—The Section Chief was Fred Dreher (1966-82) and Herb Garn (1990-present). Other personnel in the section were Barry Holmstrom, Steve Field, Pat Stark, Dan Olson, Bill Rose, and Elmer Zuehls.

The following people were in the field offices during this period: Madison Field Headquarters personnel were Joe Habale, technician-in-charge, Tom Wittwer, Ken Koenig and Steve March; Rice Lake Field Headquarters personnel were Jack Freshwaters, technician-in-charge, Ken Hedmark, Tom Popowski, and Joe Schuler; Merrill Field Headquarters personnel were Jim George, technician-in-charge, Bob Biller, Brett Esser and Jeff Hanig.

Southeast Wisconsin Subdistrict Office - During the period the office was open, Tom Ross was sub-district chief and Fred Warner was the lead technician. Other personnel who worked only in that office during this period were Paul Boetcher, Roger McFarlane and Betsy Cannon. The

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office was closed in 1984 as part of the District reduction in staff with the completion of the Milwaukee Harbor Project.

Northern Midwest Regional Aquifer System Analysis Study (RASA) – During this period, the RASA study was housed in the District office but was officially attached to the Northeastern Region. The study was completed in 1987. Harley Young and Walt Steinhilber were the project chiefs. Other personnel working on the project, within the District, were: Rick Mandle, Alan MacKenzie, Angela Kontis, and George Soulner.

SUMMARY OF PROGRAMS

Collection of Basic Records

The 1980s were a transition period for introducing computer technology into the processing of data and publication of the data report. The Director placed emphasis on getting the annual data report published. A goal was established in the late 1980s to have the report to the printer by March 31. In the late 1970s, the report was usually printed in the late summer. The District was successful in meeting these deadlines. In 1989, it went to the printer in May and, in 1992 and subsequent years, it went to the printer by the end of March.

Streamflow Stations

In 1979, the streamflow-gaging station network consisted of 127 gaging stations. This number declined to 87 by the early 1980s due to funding cutbacks by the Wisconsin Department of Natural Resources and the USGS Federal program. Unfortunately, many of the stations that were lost were stations with records greater than 30 years and representing unregulated conditions. The number of gaging stations increased to 96 by 1994 due to increased emphasis on the program.

This period also marked a big change in equipment at the gaging stations. In the late 1970s, most stations were equipped with digital recorders and mercury manometers. By 1994, mercury manometers were being replaced due to potential mercury contamination problems and digital recorders were replaced by data loggers. Many of the data loggers were linked to the District's main computer by telephone lines for retrieving streamflow data. The District made the decision to use phone lines for communication instead of DCPs like most Districts did, due to installation cost and maintenance problems with DCPs. In addition, phone lines provided two-way communication.

Ground-Water Observation Wells

In 1979, the ground-water-observation well network had 203 stations. The project was done in cooperation with the Wisconsin Geological and Natural History Survey. The number had increased to 213 by 1985 but, by 1994, it had declined back to 203 stations. In 1994, 22 were equipped with digital recorders. Several digital recorders were replaced with data loggers. Most of the levels were obtained from local observers, many of whom were county resource agents.

Water-Quality Stations

The network had eight stations in 1979 as part of the NASQAN program and one Hydrologic Benchmark station. By 1994, the network had seven NASQAN stations and one Hydrologic

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Benchmark station. Most of the water-quality monitoring stations were being operated as part of projects by 1994.

Sediment-Monitoring Stations

The sediment monitoring program in 1979 consisted of 5 stations that collected daily suspended levels. Intermittent samples were obtained from 30 miscellaneous sampling sites during high flows and used to determine annual sediment load. Funding was discontinued by 1984 for all sites except for one station—Grant River at Burton—that continued to be operated through 1994. Sediment monitoring activities continued for a number of nonpoint pollution and lake projects during the period 1979-94. Although it was recognized that a long-term sediment monitoring network was very important in the State, efforts to develop a comprehensive project were not successful.

Major Projects

In addition to the two major projects—collection of basic records at streamflow-gaging stations and ground-water observation wells—the following are other major studies that were conducted during this period.

Nonpoint Pollution Studies—A series of projects were instituted that collected streamflow and water quality at rural and urban sites to evaluate best management practices that had been implemented. The project was conducted with the WDNR with Roger Bannerman as the program coordinator. Most of the studies required intensive event sampling for streamflow and water quality.

Ground-Water Quality of Wisconsin Aquifers—A statewide project was started in 1979 to delineate and evaluate areas of known ground-water-quality problems and to define the quality of Wisconsin's ground water. The project started in 1979 and was completed by 1990. During this period, it was one of the District's largest ground-water projects and provided several very valuable reports describing the ground-water-quality conditions in the major aquifers in the State.

Effects of Acid Precipitation on Lakes in Northern Wisconsin—In 1980, studies were started to determine the mechanisms and long-term change of acid loading to five lakes in northern Wisconsin. This involved several projects that were completed by 1992.

Low-Flow Studies—Several large projects that determined the magnitude and frequency of low-flow characteristics at ungaged sites and sewage-treatment plants had begun in the late 1960s and were completed by 1987. A series of low-flow discharge measurements were made at more than 1,000 low-flow partial record stations during this period. Regional low-flow frequency equations were determined using the low-flow characteristics at the low-flow partial record stations and basin characteristics. Reports were prepared for 10 of the 12 major river basins in the State by 1984. Due to WDNR budget problems, the project was essentially stopped in 1985 and the remaining two reports were never completed. The District continued to assist the State in providing site-specific requests for low-flow estimates at sewage-treatment plants and industrial outfall sites when requested.

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Regional Flood Frequency Study for Rural and Urban Streams—This was the longest running project in the District, outside of the CBR projects, that was started in cooperation with the Wisconsin Department of Transportation in 1959. The project operated a network of 132 crest-stage gages to determine flood-frequency estimates required for bridge and culvert design as well as flood-plain management. Reports from this project that provide regional regression equations for estimating flood-frequency characteristics at ungaged sites have been the most popular in the District over the years.

County Ground-Water Studies—These studies were conducted to describe the geology and the availability, quality, and use of ground water within a county. This project was one of the primary projects conducted in the Ground-Water Section during this period with 11 reports being published. The studies were done in cooperation with the UWG&NHS.

Assessment of the Hydrology, Water Quality and Biology of Delavan Lake—In 1983, the District started this major project to determine water and chemical budgets for the lake including internal recycling of nutrients to assist in the rehabilitation of Delavan Lake which was highly eutrophic. A number of rehabilitation measures were implemented by the WDNR, EPA and the Delavan Lake Sanitary District to improve the lake. It was the largest lake in the country that EPA funded for rehabilitation. The District continued to monitor the system after the rehabilitation measures were implemented to evaluate the effectiveness.

Lake Water Quality Monitoring—The District's lake program started in 1983 with this study which collected lake samples five times per year to evaluate the trophic status of the lake. The study was done in cooperation with individual lake districts and provided the data on the eutrophic status of a lake that resulted in a large number of more detailed lake studies. In 1994, 36 lakes were being monitored. The success of this study resulted in the district having the largest lake program in the USGS.

Ground-Water Flow Model for the Area of the Proposed Crandon Mine—The District started this complex study in 1983 in cooperation with the Wisconsin DNR and University of Wisconsin Geological and Natural History Survey. The development and use of the model were used to help evaluate the impact of mining on the hydrology of the area. While the District had conducted previous ground-water system appraisals by ground-water modeling, this project helped raise the District's expertise in the State because of the importance and exposure of the Crandon mine. The District's use of ground-water models in projects increased significantly after this project.

Milwaukee Harbor Study—The District conducted a large intensive study with the Southeastern Wisconsin Regional Planning Commission during the period 1982-85. The study consisted of providing discharge and sediment data at 7 stations and water-quality data at 16 stations. The project also developed an estuary streamflow model. The project was operated from the Wales Subdistrict Office. Unfortunately, with the completion of the project, the District had significant funding problems and closed the Wales Subdistrict Office.

Flood Insurance Studies—This was a major surface-water program in the District during this period. The studies performed hydrologic and hydraulic analyses to delineate the flood

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boundaries for the 100-year flood, thereby providing data to WDNR and FEMA for establishing the flood plain for zoning and insurance rates. This required extensive surveying of stream cross-sections and water-surface profiles to conduct the analysis. Many of the District's surface-water hydrologists and hydrologic technicians worked on this project. During this period, the District completed 37 (through 1984) reports.

Superfund Remedial Response Support, EPA Region 5—The District began this project in 1988 and worked at a number of Superfund sites in Illinois, Indiana, Michigan, Ohio and Wisconsin. The service provided included drilling, monitoring well installation and packer tests. To provide this service, the District enhanced its capabilities with purchase of a new drill rig, packer rig and geoprobe.

Reports

During the 1979-94 period, the District was very productive in publishing reports. The following are the number of reports published by type: 9 water-supply papers, 62 water-resources investigations reports, 3 hydrologic atlases, 4 professional papers, 11 Wisconsin Geological and Natural History information circulars and maps, 5 open-file maps, 27 open-file reports, 1 administrative report and 29 journal articles.

A SHORT HISTORY OF THE WISCONSIN WRD DISTRICT BEFORE 1979

By Jack H. Green

The earliest reconnaissance to select gaging sites in Wisconsin was in July 1902. At that time, W. G. Leighton arranged with the Natural History Survey of Wisconsin to establish several stream-gaging and water-quality stations in the upper Mississippi Valley. Leighton returned later that year to Washington to receive his appointment as Hydrographer. He was, however, to be stationed in Chicago rather than Madison.

E. Johnson, Jr., succeeded Leighton in 1903, only to be replaced by F. W. Hanna in 1905. Wisconsin must have been a rugged training ground because Hanna left in 1906 to be followed by A. H. Horton. Horton hung on for 3 years, possibly because he directed operations from a warmer Washington, D.C. During the 1903-09 period, the field staff in the state increased to two assistants.

Significant changes occurred between 1909 and 1913 when W. G. Hoyt and R. Follansbee moved the office to St. Paul, Minnesota. By 1913, the staff had grown to six employees and three other cooperators had joined the program.

Late in 1913, Hoyt moved the office to Madison for closer work with the cooperators and better geographic location. During the first year of the new District, the budget for Wisconsin amounted to about \$11,000, with the Railroad Commission (RC) paying a full \$10,000. Hoyt continued to try to build the cooperative program until his departure in 1920.

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In the early years of S. B. Sole's tenure (1920-38), the only financial cooperator (RC) determined that Wisconsin had sufficient gaging and quality stations. Accordingly, the cooperative funds were decreased and annual budgets fell below \$10,000 until 1930. In 1931, the RC formally became the Public Service Commission (PSC) and started to expand their co-op program. With the addition of a cooperative program with the Committee on Water Pollution, the budget grew to about \$16,000 in 1938. A small amount of this money was for Minnesota. By the end of 1938, Wisconsin had 23 lake stations and 89 gaging stations, some with automatic recorders.

F. C. Christopherson became district engineer in 1938 and continued until his death in 1953. Interest in power stations was of prime importance and many dams had been constructed. In fact, by the mid-1940s, developments on the major rivers had reached the point that it was difficult to find gaging station sites with sufficient fall to afford free control. By 1947, the District had grown to 11 total personnel.

The Ground-Water Branch established an office in Madison in 1946, with F. L. Foley as the first district geologist. At the time of Foley's resignation in 1951, the district had six people on the staff. Several area and county studies were begun in cooperation with the Wisconsin Geological and Natural History Survey (WGNHS). One of Foley's first moves in 1946 was to initiate a program of statewide ground-water monitoring. This initial effort consisted of about 50 wells, about 10 with recorders.

F. T. Schaefer served as district engineer for the Surface-Water Branch from 1954 to 1960. He began a program of sediment sampling in 1954 with the Wisconsin Conservation Department (WCD). In 1959, flood studies were begun in cooperation with the Wisconsin Department of Transportation (DOT). Also about this time, the District began a research project to determine the feasibility of operating gaging stations at power dams by using turbine, gate, and spillway ratings.

The last district engineer of the Surface-Water Branch was K. B. Young. He was appointed to the position in 1960 and served until the two branches were consolidated in 1966. During these years, the crest-stage (flood) project was expanded significantly and several new projects started. A low-flow program began in cooperation with the PSC. A hydrologic benchmark station was installed on the Popple River. The two branches cooperated on a research project involving relations between ground and surface water. And, sadly, the Branch had to move away from the offices of the principal cooperator (PSC) and get by on their own for a few years.

Between 1951 and 1956, W. J. Drescher was district engineer for the Ground-Water Branch. The cooperative program with WGNHS continued to emphasize county and areal studies. Staff numbers grew to about seven during this time. By 1956, the monitoring program was expanded to about 260 wells. The coop program also had expanded to include a study of saline ground water near Lake Michigan and a study of problems caused by spraying of paper mill wastes in permeable areas.

From 1956 to 1966, C.L. R. Holt, Jr., was district geologist for the Ground-Water Branch. A field office was established in southeastern Wisconsin to accelerate county studies in that area of

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high population. The principal cooperator continued to be WGNHS, and the co-op program continued to grow. Ground-water staff more than doubled during these 10 years. A research-type project was started to demonstrate the relation between ground and surface water, and to demonstrate effects of pumping. The WCD and the WGNHS were the cooperators on this project.

In 1966, the Ground-Water and Surface-Water Branches merged into the Wisconsin WRD District Office under the leadership of C.L. R. Holt, Jr. The program expanded greatly in 1966, when the state legislature appropriated a large amount of money for water research. An enlarged program was begun with the Wisconsin Department of Natural Resources about this time also. As a result, the state is now described by a series of 12 hydrologic atlases. Later, the additional money was used to expand the county studies, and to start new studies in lakes and wetlands. Other expansion studies concerned ground-water quality and remote sensing. In these 9 years, many of the new projects considered all phases of the hydrologic cycle and discipline specialists cooperated closely. Holt left a fully consolidated district when he departed.

W. W. Barnwell served as district chief from 1975 to 1978. During that time, digital modeling of hydrologic systems was used in many projects. The District became involved in geomorphology, sediment research, land use and urban hydrology. Many of the old studies continued—counties, floods, data collection, water quality, low flow, etc. When Barnwell left, the District had about 70 full and part-time employees and temporary personnel numbered about 25.

A new chief, W. B. Mann IV, came on board in 1979. By this time, the district program had grown to 39 projects with a budget of more than \$2,000,000.